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(54) MOVING IMAGE DECODING TIMING ESTIMATE METHOD, MOVING IMAGE CODER AND MOVING IMAGE DECODER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide the moving image decoding timing estimate method, the moving image coder, and the moving image decoder in which a decoding timing of a coding frame to be decoded 2nd is estimated accurately with a small arithmetic operation amount in the case of decoding the coding frame of the moving image.

SOLUTION: An MPEG video decoder 403 extracts a number denoting a display order of coded frames decoded at first from a video bit stream 407, identification data of frame structure/field structure, identification data of a display method of a pattern in the case of a frame structure, identification data of frame structure/field structure of a coded frame decoded 2nd, identification data of a display method of a pattern in the case of a frame structure and data denoting a display period of a pattern. A decoding start time of

a 2nd coding frame is estimated based on data extracted by a decoding start timing control circuit 408 and continuity of pattern display and the decoder 403 decodes the coding frame.

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2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] In the dynamic-image decode timing presumption approach of presuming the decode timing at the time of decoding the coding frame of a dynamic image When the number of the order of a display of the coding frame decoded first is one, the decode initiation timing of the coding frame decoded to the 2nd When the number of the order of a display of the coding frame which presumes to be the time of display initiation of the coding frame decoded first, and is decoded first is two and the display period of the coding frame decoded to the 2nd is 2 field period, the decode initiation timing of the coding frame decoded to the 2nd ** decoded first When the display period of the coding frame which presumes to be 2 field period before at the time of display initiation of a number-ized frame, and is decoded to the 2nd is 3 field period, the decode initiation timing of the coding frame decoded to the 2nd ** decoded first When the number of the order of a display of the coding frame which presumes to be 3

field period before at the time of display initiation of a number-ized frame, and is decoded first is three and the coding frame decoded first is the frame structure, The field displayed on the beginning of the coding frame decoded to the beginning is the same as the field where the coding frame decoded to the 2nd is displayed on the beginning by the frame structure. When the display periods of the coding frame decoded to the 2nd are the 2 fields, and the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure The field displayed on the beginning of the coding frame decoded to the beginning is the same as the field displayed on the beginning. When the display periods of the coding frame decoded to the 2nd are the 3 fields, and the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the field displayed on the beginning differs from the field displayed on the beginning of the coding frame decoded to the beginning, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 5 field period before

at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the high order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the high order field The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the high order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the low order field The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the low order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the high order field The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the low order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the low order field The coding frame which the

coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded first decodes to the 2nd at the time of the high order field in field structure by the frame structure When the display periods of the coding frame which the high order field is previously displayed and is decoded to the 2nd are the 2 fields, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the display periods of the coding frame which the high order field is previously displayed and is decoded to the 2nd are the 3 fields, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the low order field is displayed previously, the decode initiation timing of the coding frame decoded to the 2nd At the time of the high order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd At the time of the low

order field [in / in the coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd The coding frame which the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded first decodes to the 2nd at the time of the low order field in field structure by the frame structure The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd is the frame structure, and the decode initiation timing of the coding frame decoded to the 2nd when the high order field is displayed previously is a low order fee. When the display periods of the coding frame which RUDO is previously displayed and is decoded to the 2nd are the 2 fields, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the display periods of the coding frame which the low order field is previously displayed and is decoded to the 2nd are the 3 fields, the decode initiation timing of the coding frame decoded to the 2nd At the time of the

high order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd At the time of the low order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd is the dynamic-image decode timing presumption approach characterized by presuming 4 field period before at the time of display initiation of the coding frame decoded first.

[Claim 2] In the case of the number and the discernment data of the frame structure / field structure in which the order of a display of the coding frame decoded by the beginning is shown from the coded data train of a dynamic image, and the frame structure, the discernment data of the method of presentation of a screen, The discernment data of the frame structure / field structure of the coding frame decoded by the 2nd, and an extract means to extract the discernment data of the method of presentation of a screen, and the data in which the display period of a screen is shown in the case of the frame

structure, Dynamic-image decryption equipment characterized by decoding said coding frame based on the time of the decode initiation which possessed each data extracted with this extract means, and a presumed means to presume the time of decode initiation of the 2nd coding frame based on the continuity of a display of a screen, and was presumed with this presumed means.

[Claim 3] In the case of the number and the discernment data of the frame structure / field structure in which the order of a display of the coding frame decoded by the beginning is shown from the coded data train of a dynamic image, and the frame structure, the discernment data of the method of presentation of a screen, The discernment data of the frame structure / field structure of the coding frame decoded by the 2nd, and an extract means to extract the discernment data of the method of presentation of a screen, and the data in which the display period of a screen is shown in the case of the frame structure, Dynamic-image coding equipment characterized by providing each data extracted with this extract means, and a calculation means to compute the decode timing of the 2nd coding frame based on the continuity of a display of a screen, and adding said computed decode timing information to said coding frame.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the decode timing presumption

approach, the dynamic-image coding equipment using it, and dynamic-image decryption equipment of the dynamic image in the MPEG system which synchronizes and multiplexes coded data trains encoded for example, according to an individual, such as a dynamic image and voice.

[0002]

[Description of the Prior Art] There are mainly MPEG1 system corresponding to the application of are recording media, such as CD-ROM, and an MPEG 2 system corresponding to the broad application containing the application of this MPEG1 as MPEG system [-izing / carries out multiplex / of the data streams encoded according to the individual, such as a dynamic image (video) and voice (audio), / the synchronization and multiplex /, and / the data streams / system / 1].

[0003] In such an MPEG system, Time Division Multiplexing of the separate data stream (stream) which encoded video, an audio, etc. according to the individual and was obtained is carried out, and it is made one stream, and it records on are recording media, or transmits through a communication network. In a playback side, the stream according to each is separated from the multiplex stream which was read from are recording media or was received through the communication

network, a stream is decoded according to an individual with delivery and each compound vessel to each decoder, and it outputs to output units (a video monitor, loudspeaker, etc.). In that case, as meant by the transmitting side, by the receiving side, the stream according to each is synchronization-decoded and a playback output is carried out.

[0004] by the way -- the coded image of MPEG -- all the screens -- intra -- the intra to encode -- there are three image types called the bidirectional predicting-coding image (B picture) also using the forward direction prediction from a coded image (I picture), an inter-frame forward direction predicting-coding image (P picture), and the past playback image and the hard flow prediction from the playback image of the future.

[0005] Since it is necessary to refer to not only the past playback image but the playback image of the future when B picture of bidirectional predicting coding is inserted, cautions are required for the processing sequence of a screen to differ from the sequence of a subject-copy side.

[0006] That is, in an encoder, B picture is skipped, the following I and P picture are encoded previously, and B picture which is in between is encoded after that. Although a decoder is decoded immediately and displays B picture, I and P

picture are displayed, after decoding and processing of B picture which enters in between is completed. Therefore, when it lets an encoder and a decoder pass, delay of only the period in which I or P picture appears will occur.

[0007] It is drawing 8 which showed this situation concretely. The relation of an input image (subject-copy image), a coded image, and a display image is expressed with drawing 8 including the difference of the order of processing of a screen and the sequence of a subject-copy side.

[0008] In drawing 8 , b12 and b13 express B picture contained in GOP (screen group structure where at least one Groupof Picture:I picture entered) of eye watch (n-1), and p14 expresses p picture of the last of GOP of eye watch (n-1).

[0009] I2 expresses I picture of the beginning of n-th GOP, p5 expresses p picture of the beginning of n-th GOP, and B0, B1, B3, and B4 express B picture contained in n-th GOP.

[0010] The interval Txx (xx=B [0],5 [B1, I2, --, P5], --) of the decode between each picture is the display time of the picture which displays while decoding. Namely, (1) If current and B picture are decoded, the interval to decode initiation of the following picture is a period when the B picture is displayed.

[0011] (2) If current, I, or P picture is decoded, the interval to decode initiation of

the following picture is a period when I or P picture which decoded immediately before is displayed.

[0012] At MPEG1, although only the image of sequential scanning (non-interlace) is treated, by MPEG 2, not only the image of sequential scanning but the image of an interlace scan (interlaced scanning) can be treated. The difference between a progressive broadcasting method and an interlace scanning mode is briefly explained with reference to drawing 9 .

[0013] Drawing 9 shows taking the case of the case (refer to drawing 9 (a)) with a 30Hz (in detail 29.97Hz) progressive broadcasting method (refer to drawing 9 (b)) and a 30Hz interlace scanning mode of 60Hz, i.e., field frequency. by sequential scanning, although all the images in one frame are sampled by the same time amount, by the interlace scan, what was sampled by the time amount from which the image in one frame differed is repeated by turns for every line (namely, odd lines and even lines -- alternation). On the 1st field, the 2nd field, and the screen of a call and an interlace scan, one frame will usually consist of field images of two sheets in the image sampled by this different time amount, respectively (refer to drawing 9 (a)).

[0014] In MPEG 2, assigning a frame to a picture (image unit of one sheet in

MPEG) can also assign the field. When a frame is assigned to a picture, this way of assigning is called the frame structure. When the field is assigned to a picture, this way of assigning is called field structure. The frame structure and field structure may be intermingled in one image sequence, and you may encode only with one of structures.

[0015] On the other hand, in MPEG1, since it is a progressive broadcasting method, all are treated as a frame image and the display time of one frame is 2 field period. In MPEG 2, the period which displays one frame can be set as the 2 field or the 3 fields, and arbitration. For example, when frame rate conversion of the movie source with a frame period of 24Hz is carried out with the television equipment of an interlace with a frame period [of NTSC system] of 30Hz and it is displayed, it encodes by carrying out multiplex [of the flag (TFF, RFF) showing the information on the telecine conversion called 2:3 PURUDAUN].

[0016] Here, in Flag TFF (top field first), in the case of the frame structure, the field displayed first shows a high order (top field) or low order (bottom field), and, as for Flag REF (repeat first field), the display period of one picture shows the 2 fields and the 3 field. In addition, these two flags are data given for every picture.

[0017] Now, the case where it enters from the middle of coded data is

considered like [at the time of random access and a channel hopping] here. For example, when starting decode from n-th GOP of drawing 8 , there is no image which displays at the time of the first I or decode of P picture. In such a case, since the display time of the decode image p14 in drawing 8 is unknown, it cannot specify whether the interval to decode initiation of B0 picture which decodes to the degree of I2 picture is behind 2 fields, or it is behind 3 fields.

[0018] Moreover, also at the time of the start-up of a sequence, similarly, when it is unknown whether it encoded by a coding side making the 2 fields the decode interval of I2 picture and B0 picture or it encoded by making it the 3 fields, the same problem as the above-mentioned occurs.

[0019] In order to presume the decode start time of B0 picture conventionally, there are the following approaches. That is, multiplex [of the buffer residence time (VD:VBV Delay) after the cutting tool of the head of each encoded picture is inputted into a receive buffer as additional information until it uses for decode] is carried out to the image data encoded by the MPEG method. This value of VD expresses the number of clocks when measuring with a 90Hz clock by 16 bits. The occupation Bn of VD and a receive buffer and the relation of the transmission rate R serve as VD=90000xBn/R.

[0020] It is more possible than this to start decode of B0 picture at the time of day when the occupation of a receive buffer was set to Bn. However, by this approach, since it is necessary to do a division in order to calculate Bn, we are anxious about the scale of hardware. Moreover, since the case where the transmission rate R changes per picture, and the value of VD may be recorded with the special value of "0xFFFF" when adjustable rate coding is performed, it becomes very difficult to calculate Bn.

[0021] On the other hand, in MPEG1 which is the conventional dynamic-image coding technique, there is no flag (TFF, RFF) showing the information on the telecine conversion called 2:3 PURUDAUN, and all were treated as a frame image. Therefore, when decoding the dynamic-image signal encoded by MPEG1, the time of day which starts decode of B0 picture is good after [of decode of I2 picture] one frame (2 field).

[0022]

[Problem(s) to be Solved by the Invention] In MPEG 2, since a 2:3 pulldown ****** image may be treated as mentioned above, there is [whether it is behind 2 fields and 3 fields, and] a trouble that it cannot specify easily, from decode of the coded image (I2 picture) into which the time of day which starts decode of the

coded image (B0 picture) inputted into the 2nd was inputted first.

[0023] That is, it is in order to presume the decode start time of B picture which decodes to the degree of the first I picture in the former (1). In the case of a fixed transmission rate, the increment in hardware is expected.

(2) In the case of an adjustable transmission rate, with the conventional technique, it is impossible.

There was a trouble to say.

[0024] If decode start time is not presumed correctly, there is a possibility that overflow and the underflow of the receive buffer which stores the received compressed data may occur, and there is a possibility that decode may no longer be performed normally. Moreover, in an MPEG system, it is a playback side and it becomes difficult to carry out the synchronous decode of video and the audio. Similarly, unless it can hold initiation timing of decode correctly to the sign side of an MPEG system, multiplex [of other data, such as an audio,] will not be carried out to proper time of day.

[0025] Then, this invention was made in view of the above-mentioned trouble, and aims at offering the dynamic-image decode timing presumption approach that the decode timing of the coding frame which decodes to the 2nd at the time

of decoding the coding frame of a dynamic image can be correctly presumed in the small amount of operations, the dynamic-image coding equipment using it, and dynamic-image decryption equipment.

[0026]

[Means for Solving the Problem] In the dynamic-image decode timing presumption approach of presuming the decode timing at the time of the dynamic-image decode timing presumption approach of this invention decoding the coding frame of a dynamic image When the number of the order of a display of the coding frame decoded first is one, the decode initiation timing of the coding frame decoded to the 2nd When the number of the order of a display of the coding frame which presumes to be the time of display initiation of the coding frame decoded first, and is decoded first is two and the display period of the coding frame decoded to the 2nd is 2 field period, the decode initiation timing of the coding frame decoded to the 2nd ** decoded first When the display period of the coding frame which presumes to be 2 field period before at the time of display initiation of a number-ized frame, and is decoded to the 2nd is 3 field period, the decode initiation timing of the coding frame decoded to the 2nd ** decoded first When the number of the order of a display of the coding frame

which presumes to be 3 field period before at the time of display initiation of a number-ized frame, and is decoded first is three and the coding frame decoded first is the frame structure, The field displayed on the beginning of the coding frame decoded to the beginning is the same as the field where the coding frame decoded to the 2nd is displayed on the beginning by the frame structure. When the display periods of the coding frame decoded to the 2nd are the 2 fields, and the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure The field displayed on the beginning of the coding frame decoded to the beginning is the same as the field displayed on the beginning. When the display periods of the coding frame decoded to the 2nd are the 3 fields, and the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the field displayed on the beginning differs from the field displayed on the beginning of the coding frame decoded to the beginning, the decode initiation timing of the coding frame decoded to the 2nd The coding

frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the high order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the high order field The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the high order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the low order field The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the low order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of the high order field The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd in the low order field in field structure The field displayed on the beginning of the coding frame decoded first the decode initiation timing of the coding frame decoded to the 2nd at the time of

the low order field The coding frame which the coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded first decodes to the 2nd at the time of the high order field in field structure by the frame structure When the display periods of the coding frame which the high order field is previously displayed and is decoded to the 2nd are the 2 fields, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the display periods of the coding frame which the high order field is previously displayed and is decoded to the 2nd are the 3 fields, the decode initiation timing of the coding frame decoded to the 2nd The coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the low order field is displayed previously, the decode initiation timing of the coding frame decoded to the 2nd At the time of the high order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding

frame decoded to the 2nd At the time of the low order field [in / in the coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd The coding frame which the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded first decodes to the 2nd at the time of the low order field in field structure by the frame structure When the high order field is displayed previously, the decode initiation timing of the coding frame decoded to the 2nd When the display periods of the coding frame which the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd is previously displayed, and the low order field decodes to the 2nd by the frame structure are the 2 fields, it decodes to the 2nd. The decode initiation timing of the coding frame to carry out The coding frame which presumes to be 4 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd by the frame structure When the display periods of the coding frame which the low order field is previously displayed and is decoded to the 2nd are the 3 fields, the decode

initiation timing of the coding frame decoded to the 2nd At the time of the high order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd At the time of the low order field [in / in the coding frame which presumes to be 5 field period before at the time of display initiation of the coding frame decoded first, and is decoded to the 2nd / field structure] The decode initiation timing of the coding frame decoded to the 2nd By presuming 4 field period before at the time of display initiation of the coding frame decoded first, the decode timing of the coding frame which decodes to the 2nd at the time of decoding the coding frame of a dynamic image can be correctly presumed in the small amount of operations.

[0027] The dynamic-image decryption equipment of this invention moreover, from the coded data train of a dynamic image In the case of the number and the discernment data of the frame structure / field structure in which the order of a display of the coding frame decoded first is shown, and the frame structure, the discernment data of the method of presentation of a screen, The discernment data of the frame structure / field structure of the coding frame decoded by the

2nd, and an extract means to extract the discernment data of the method of presentation of a screen, and the data in which the display period of a screen is shown in the case of the frame structure, Based on the continuity of each data extracted with this extract means, and a display of a screen By providing a presumed means to presume the time of decode initiation of the 2nd coding frame, and decoding said coding frame based on the time of the decode initiation presumed with this presumed means The decode timing of the coding frame which decodes to the 2nd at the time of decoding the coding frame of a dynamic image can be correctly presumed in the small amount of operations.

[0028] The dynamic-image coding equipment of this invention moreover, from the coded data train of a dynamic image In the case of the number and the discernment data of the frame structure / field structure in which the order of a display of the coding frame decoded first is shown, and the frame structure, the discernment data of the method of presentation of a screen, The discernment data of the frame structure / field structure of the coding frame decoded by the 2nd, and an extract means to extract the discernment data of the method of presentation of a screen, and the data in which the display period of a screen is shown in the case of the frame structure, Based on the continuity of each data

extracted with this extract means, and a display of a screen By providing a calculation means to compute the decode timing of the 2nd coding frame, and adding said computed decode timing information to said coding frame The decode timing of the coding frame which decodes to the 2nd at the time of decoding the coding frame of a dynamic image can be correctly presumed in the small amount of operations.

[0029]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. Drawing 1 shows an example of the DS of MPEG 2 roughly. Although the image data encoded by MPEG 2 takes the hierarchy organization from a top to a sequence layer, a GOP layer, a picture layer, --, a block layer, it shows the sequence layer and the GOP layer by drawing 1 .

[0030] The DS of a sequence layer serves as a sequence header (SH) containing the data (for example, PS which shows that it is sequential scanning (Progressive Sequence)) of a screen group (GOP) with a series of same attributes from the data of GOP.

[0031] The DS of a GOP layer serves as a GOP header containing data common

to two or more screens which constitute the screen group (GOP) who becomes the unit of random access from the data of each screen (picture) which constitutes the GOP.

[0032] The DS of a picture layer serves as a picture header containing the data (for example, TR, TFF, REF, PSTR, etc.) of an attribute common to the screen of one sheet from the coded data of each screen (I picture, P picture, B picture) for every screen.

[0033] In an MPEG system, it is decomposed into further two or more packets, and Time Division Multiplexing of both the audio packets etc. is carried out, and the data of such MPEG 2 of structure generate one data stream for them. SCR which is the information for setting and proofreading the value of STC (basic synchronizing signal) which serves as time-of-day criteria in the MPEG system decoder containing decoders, such as video and an audio, in that case at the value meant by the encoder side (System Clock Reference), The unit of the decode playback called an access unit (that is, video one frame) As for an audio, PTS (Presentation Time Stamp) which is the time-of-day-control information on a playback output, and DTS (Decoding Time Stamp) which is the time-of-day-control information on decode are added if needed to every 1 audio

frame.

[0034] When the time-of-day criteria STC in the decoder of an MPEG system are in agreement with PTS, the playback output of the access unit is carried out. PTS is expressed with the value measured with the 90kHz clock.

[0035] In MPEG, DTS attaches both time stumps, when it was prepared corresponding to the sequence to decode differing from the sequence which carries out a playback output since I picture and P picture are preceded rather than B picture and sent out to a coded data train and PTS differs from DTS, and when in agreement, it attaches only PTS.

[0036] Next, the decode timing presumption approach concerning this operation gestalt is explained with reference to the flow chart shown in drawing 2 and drawing 3 . In addition, in the following explanation, a coding frame is the coded data of one screen which is a candidate for coding, and 1 coding frame is constituted from the field image of two sheets by interlace scan.

[0037] First, the data defined by MPEG 2 used by this decode timing presumption approach, i.e., TR, TFF, and REF, and PSTR are explained. These are added to the picture layer by the DS of MPEG 2.

[0038] TR (Temporal Reference) is a number which shows the order of a display

of a picture. By drawing 2 and drawing 3 , it is in the head of GOP, namely, the sequence of decode processing indicates TR of the first coding frame to be TR0. Drawing 2 and drawing 3 show TR 0= 0 and the case of 1 and 2 as a value of TR0.

[0039] A coding frame shows the frame structure or field structure, and in the case of field structure, PSTR (Picture Structure) is doubled the low order field (bottom) in the high order field (top), and shows. By drawing 2 and drawing 3 , the values of PSTR are indicated to be PSTR= "fram", "top", and "bottom." Moreover, by drawing 2 and drawing 3 , the sequence of PSTR0 and decode processing indicates [the sequence of decode processing] PSTR of the 2nd coding frame to be PSTR1 for PSTR of the first coding frame.

[0040] The field where TFF (Top Field First) is first displayed when a coding frame is the frame structure shows the high order field (top) or the low order field (bottom). Drawing 2 and drawing 3 show what it displays from top and is displayed from bottom at the time of TFF=1 at the time of TFF=0. Moreover, by drawing 2 and drawing 3 , the sequence of decode processing indicates TFF of the coding frame of 0 or 2nd TFF to be TFF1 for TFF of the first coding frame.

[0041] REF (Repeaat First Field) is used in the case of 2:3 PURUDAUN, and the

display period of 1 coding frame shows the 2 fields and the 3 field. By drawing 2 and drawing 3 , the 2 field shows that it is the 3 field at the time of REF=1 at the time of REF=0. Moreover, by drawing 2 and drawing 3 , REF of the coding frame of 0 or 2nd REF is indicated to be REF1 for REF of the first coding frame.

[0042] Based on the criteria time of day STC, the value of 1 field period expressed with the number of clocks of 90kHz is indicated to be FPRD in drawing 2 and drawing 3 . When PTS of the first coding frame and DTS are set to PTS0 and DTS0, respectively, by the decode timing presumption approach of this invention The information on PST1 and TFF1 which were added to the 2nd coding frame, TR0, PSTR0 and PTS0 which were added to the first coding frame, and TFF0 grade is used effectively. When the 2nd coding frame is obtained, it aims at presuming the decode start time DTS 1 of the 2nd coding frame.

[0043] In addition, the dynamic-image data dealt with here shall be sequential scanning including B picture (LD(low drlay) =0) (PS(progressive sequence) =0). LD and PS are data added to a sequence layer with the data FRC (frame rate code) which identify the display period (for example, 24Hz / 29.97Hz) of an image.

[0044] First, the first coding frame explains the case where TR 0= 2, PSTR0=

"frame", TFF 0= 1, and the 2nd coding frame are PSTR1= "frame", TFF 1= 0, and REF 1= 0.

[0045] At step S1, since the display number of TR 0= 2, i.e., the first coding frame, is "2", it progresses to step S4. By step S4, since PSTR0= "frame", i.e., the first coding frame, is the frame structure, it progresses to step S5.

[0046] At step S5, since PSTR1= "frame", i.e., the 2nd coding frame, is the frame structure, it progresses to step S8. At step S8, as for TFF 0= 1 and TFF 1= 0, i.e., the first coding frame, the high order field is displayed previously, and since the low order field is displayed previously, the 2nd frame progresses to step S14 of drawing 3 .

[0047] In this case, with reference to drawing 4 , it explains concretely. Two coding frames (B picture) are inserted until the first coding frame (I2) is displayed from TR 0= 2, but since I2 is moreover TFF=1 in the frame structure, the display of I2 is started from the high order (top) field.

[0048] Moreover, since the 2nd coding frame B0 is moreover TFF 1= 0 in the frame structure, the display of B0 is started from the low order field (bottom). Moreover, since it is REF 1= 0, the display periods of B0 are the 2 fields.

[0049] Therefore, as shown in drawing 4 , BO is displayed as bottom->top and I2

is displayed from top. In the case of a screen display, the bottom field and the top field will be displayed by turns, and will surely call this "the continuity of a display."

[0050] In this example, although the display period of the coding frame (B picture) B1 of another side displayed before I2 is displayed is unknown, if the display period of B1 can be specified, it can understand temporarily easily that what lengthened the display period of B0 and B1 becomes the decode start time of B0 from the display time of day PST 0 of I2.

[0051] Now, as for B picture (B1) displayed on the 2nd, the continuity of a display shows that it is the display of an odd number field period, as shown in drawing 4 . Furthermore, since, as for each coding frame, only the display of 2 or 3 field period is allowed, B1 can judge that it is the display of 3 field period.

[0052] Therefore, it is presumed that the decode start time DTS 1 of B0 comes in front of 5 fields of the display indication time of day of I2 (refer to drawing 4). That is, in step S14 of drawing 3 , the decode start time DTS 1 of BO can be found from a degree type (1).

[0053]

DTS1=PTS0-5xFPRD -- (1)

When both I2 and B0 are previously displayed from the low order field or the high order field at step S8 in the time of TFF0=TFF 1= 0 or TFF0=TFF 1= 1, i.e., drawing 4 , it progresses to step S13 of drawing 3 .

[0054] At step S13, it turns out that the decode start time DTS 1 of the 2nd coding frame B0 can be found from a degree type (2) according to the value of RFF1 based on the same principle as the above-mentioned.

DTS1=PTS0-2x(2+RFF1) xFPRD -- (2)

At step S5, when the 2nd coding frame B0 is PSTR1= "top" (i.e., when a display is started from the high order field), it progresses to step S9.

[0055] In step S9, the display period of the coding frames B0 and B1 displayed before I2 is presumed based on the value of TFF0 of the first coding frame I2, and the continuity of a display. Namely, at the time of TFF 0= 1, it progresses to step S15 and progresses to step S14 at the time of TFF 1= 0.

[0056] At step S15, since the display period of the coding frames BO and B1 is presumed to be the 4 field, it can ask for the decode start time DTS 1 of B1 from a degree type (3).

[0057]

DTS1=PTS0-4xFPRD -- (3)

It becomes. At step S14, since the display periods of the coding frames B0 and B1 are presumed to be the 5 fields, the decode start time DTS 1 of B1 can be found from (1) type.

[0058] At step S5, when the 2nd coding frame B0 is PSTR1= "bottom" (i.e., when a display is started from the low order field), it progresses to step S10.

[0059] At step S10, the display period of the coding frames B0 and B1 displayed before I2 is presumed based on the value of TFF0 of the first coding frame I2, and the continuity of a display. That is, since the display periods of the coding frames B0 and B1 can be presumed to be the 5 fields at the time of TFF 0= 1, it progresses to step S14, and since the display periods of the coding frames B0 and B1 can be presumed to be the 4 fields at the time of TFF 1= 0, it progresses to step S15.

[0060] By step S4, when the first coding frame I2 is PSTR0= "top", I2 is field structure and, moreover, in the case of the high order field, it progresses to step S6.

[0061] At step S6, when the 2nd coding frame is PSTR1= "fram" (i.e., when B0 is the frame structure), it progresses to step S11. At step S11, BO and the display period of B1 are presumed based on the value of TFF1 of the 2nd coding frame

B0, and the continuity of a display. Namely, at the time of TFF 1= 1, it progresses to step S13 and progresses to step S14 at the time of TFF 1= 0.

[0062] At step S6, when the 2nd coding frame is PSTR1= "top", namely, since B0 is field structure and the display period of B0 and B1 can moreover presume the 4 fields at the time of the high order field, it progresses to step S15.

[0063] At step S6, when the 2nd coding frame is PSTR1= "bottom", namely, since B0 is field structure and the display period of B0 and B1 can moreover presume the 5 fields at the time of the low order field, it progresses to step S14.

[0064] By step S4, when the first coding frame I2 is PSTR0= "bottom", I2 is field structure and, moreover, in the case of the low order field, it progresses to step S7.

[0065] At step S7, when the 2nd coding frame is PSTR1= "fram" (i.e., when B0 is the frame structure), it progresses to step S12. At step S12, BO and the display period of B1 are presumed based on the value of TFF1 of the 2nd coding frame B0, and the continuity of a display. Namely, at the time of TFF 1= 1, it progresses to step S14 and progresses to step S13 at the time of TFF 1= 0.

[0066] At step S7, when the 2nd coding frame is PSTR1= "top", namely, since B0 is field structure and the display period of B0 and B1 can moreover presume

the 5 fields at the time of the high order field, it progresses to step S14.

[0067] At step S7, when the 2nd coding frame is PSTR1= "bottom", namely, since B0 is field structure and the display period of B0 and B1 can moreover presume the 4 fields at the time of the low order field, it progresses to step S15.

[0068] Next, the first coded image explains the case where TR 0= 1, PSTR0= "frame", and the 2nd coding frame are PSTR1= "frame" and REF 1= 0.

[0069] At step S1, it progresses to step S3 at the time of TR 0= 1, i.e., when the display number of the first coding frame is "1." In this case, with reference to drawing 5 , it explains concretely. Although one coding frame of B picture is inserted from TR 0= 1 until the first coding frame I2 is displayed, as for the 2nd coding frame B0, REF 1= 0 shows that the display period turns into 2 field period. That is, it is presumed that the decode start time DTS 1 of B0 comes in front of 2 fields of the display start time of the first coding frame I2.

[0070] When the 2nd coding frame B0 is REF 1= 1, the display period turns into 3 field period. That is, it is presumed that the decode start time DTS 1 of B0 comes in front of 3 fields of the display start time of the first coding frame I2.

[0071] If these are summarized, in step S3 of drawing 3 , it can ask for the decode start time DTS 1 of B0 from a degree type (4).

DTS1=PTS0-(2+REF1) xFRPD -- (4)

At step S1, the case where the image in the GOP is refreshable independently of other GOP(s) can be considered at the time of TR 0= 0, i.e., when the display number of the first coding frame is "0." At this time, it progresses to step S2 and the decode time of day DTS 1 of the 2nd coding frame becomes the same as the display start time PTS0 of the first coding frame.

[0072] As mentioned above, as explained, according to the above-mentioned dynamic-image decode timing presumption approach The number (TR0) and the discernment data (PSTR0) of the frame structure / field structure in which the order of a display of the coding frame decoded first is shown, and in the case of the frame structure, the discernment data of the method of presentation of a screen (TFF0), The discernment data of the frame structure / field structure of the coding frame decoded by the 2nd (PSTR1), The discernment data (TFF1) of the method of presentation of a screen, the data in which the display period of a screen is shown (RFF1), the display start time (PTS0) of the coding frame first decoded based on the continuity of a display of a screen -- what -- whether decode of the 2nd coding frame is started before a field period That is, the decode start time (DTS1) of the 2nd coding frame can be correctly presumed in

the small amount of operations.

[0073] In addition. Although drawing 2 , 3, and the case where the values of TR were 0, 1, and 2 were explained, it does not restrict to this and it becomes same to mention presumption of decode start time above possible according to the value of TR.

[0074] Next, it considers applying this decode timing presumption approach to the encoder and decoder of an MPEG system. Drawing 6 shows roughly the configuration of the important section by the side of the decoder of an MPEG system. If the multiplexed bit streams (it is hereafter called an MPEG bit stream) 401, such as MPEG1 or video of MPEG 2, and an audio, are read from are recording media or are received through a network, it will be first inputted into the MPEG system decoder 402.

[0075] The MPEG system decoder 402 performs the following processings.

(1) Separate the bit stream 407 of video from the MPEG bit stream 401, and output to the MPEG video decoder 403.

[0076] (2) Separate the bit stream 412 of an audio from the MPEG bit stream 401, and output to the audio decoder 413.

(3) Separate the time-of-day-control information (PTS) 405 on the playback

output of the first coding frame, and the time-of-day-control information (DTS) 406 on decode from the MPEG bit stream 401, and output to the decode initiation timing control circuit 408.

[0077] (4) Separate the system time-of-day criteria reference value (SCR) 404 from the MPEG bit stream 401, output to the decode initiation timing control circuit 408, and set the STC counter used as the MPEG time-on-the-system criteria of providing based on it.

[0078] When the value of an STC counter and the value of the decode initiation timing control circuit 40 of DTS of the first coding frame correspond, it outputs the decode start signal 410 to an MPEG video decoder.

[0079] The MPEG video decoder 403 starts decode of the first coding frame in response to the decode start signal 410, and outputs a video signal 411. The MPEG video decoder 403 separates the data of the method of presentation (namely, LD, PS, FRC) expected from the video sequence of structure as shown in drawing 1 . Furthermore, the number (TR0) and the discernment data (PSTR0) of the frame structure / field structure in which the order of a display of the coding frame contained at the head (picture header) of the first coding frame is shown, and in the case of the frame structure, the discernment data (TFF) of

the method of presentation of a screen are separated, and these data 409 are outputted to the decode initiation timing control circuit 408.

[0080] Next, after decode of the first coding frame is completed by the MPEG video decoder 403, the discernment data (PSTR1) of the frame structure / field structure included at the head (picture header) of the 2nd coding frame, the discernment data (TFF1) of the method of presentation of a screen, and the data (RFF1) in which the display period of a screen is shown are outputted to separation, and these data 409 are outputted to the decode initiation timing control circuit 408.

[0081] In the decode initiation timing control circuit 408, when the decode start time of the 2nd coding frame is computed and the value of the computed time of day and STC counter is in agreement according to the flow chart shown in drawing 2 and drawing 3 , the decode start signal 410 is outputted.

[0082] In the MPEG video decoder 403, in response to the decode start signal 410, decode of the 2nd coding frame is started and a video signal 411 is outputted. On the other hand, the decode initiation timing control circuit 408 outputs the decode start signal 416 of an audio so that synchronous playback of PTS415 separated from the bit stream of an audio may be carried out with a

video signal based on reception and it from the audio decoder 413.

[0083] The audio decoder 413 receives the audio bit stream 412, is carried out through decode with the decode start signal 416, and outputs the decoded audio signal 414.

[0084] Drawing 7 shows roughly the configuration of the important section by the side of the encoder of an MPEG system. The bit stream 501 of the encoded video is inputted into the video syntax interpretation section 502, and is inputted into it and coincidence at the system multiplex section 503.

[0085] The video syntax interpretation section 502 separates the data of the method of presentation (namely, LD, PS, FRC) expected from the video sequence of structure as shown in drawing 1 . Furthermore, the number (TR0) and the discernment data (PSTR0) of the frame structure / field structure in which the order of a display of the coding frame contained at the head (picture header) of the first coding frame is shown, and in the case of the frame structure, the discernment data (TFF) of the method of presentation of a screen are separated, and these data 505 are outputted to the PTS/DTS calculation circuit 504.

[0086] The MPEG system encoder 503 performs the following processings.

(1) To the coding frame of the beginning of the bit stream 501 of video, carry out multiplex [of suitable PTS and DTS], and output the data 506 of PTS and DTS to this first coding frame to the PTS/DTS calculation circuit 504.

[0087] (2) Carry out multiplex [of the suitable PTS] to the bit stream 509 of the encoded audio.

(3) Output the bit stream 508 of an MPEG system by carrying out multiplex [of the bit stream of an audio] to video.

[0088] In the PTS/DTS calculation circuit 504, according to the flow chart shown in drawing 2 and drawing 3 , PTS and DTS of the 2nd coding frame are computed, and these data 507 are outputted to the MPEG system encoder 503.

[0089] To the 2nd coding frame, it refers to these values and multiplex timing is controlled by the MPEG system encoder 503. Moreover, multiplex [of PTS and DTS which were computed in the PTS/DTS calculation circuit 504] is carried out if needed, and the bit stream 508 of an MPEG system is outputted.

[0090] The multiplexing bit stream 508 was accumulated for example, in are recording media, or was distributed to user ** through the network, and is come. Since the decode timing of the coding frame which decodes to the 2nd at the time of decoding the coding frame of a dynamic image can be correctly

presumed in the small amount of operations according to the decryption equipment of the MPEG system concerning the above-mentioned operation gestalt as explained above (1) The synchronous playback of video and the audio can be carried out correctly.

(2) The overflow or the underflow at the time of decode initiation of the receive buffer which receives the bit stream of video and is accumulated temporarily can be prevented beforehand.

[0091] Moreover, according to the coding equipment of the MPEG system concerning the above-mentioned operation gestalt, it is (1). It can carry out synchronous multiplex [of the audio] to video correctly.

(2) In case it carries out multiplex [of the audio] to video, the overflow of a buffer or the underflow which accumulates these bit streams temporarily can be prevented beforehand.

[0092]

[Effect of the Invention] As explained above, according to this invention, the dynamic-image decode timing presumption approach that the decode timing of the coding frame which decodes to the 2nd at the time of decoding the coding frame of a dynamic image can be correctly presumed in the small amount of

operations, the dynamic-image coding equipment using it, and dynamic-image decryption equipment can be offered.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing having shown an example of the DS of MPEG 2.

[Drawing 2] The flow chart for explaining the procedure of the decode timing presumption approach.

[Drawing 3] The flow chart for explaining the procedure of the decode timing presumption approach.

[Drawing 4] Drawing for explaining concretely the presumed approach of the decode initiation timing of the 2nd coding frame in case the order of a display of the first coding frame is "2."

[Drawing 5] Drawing for explaining concretely the presumed approach of the decode initiation timing of the 2nd coding frame in case the order of a display of the first coding frame is "1."

[Drawing 6] Drawing having shown roughly the configuration of the important section of the decryption equipment of an MPEG system.

[Drawing 7] Drawing having shown roughly the configuration of the important section of the coding equipment of an MPEG system.

[Drawing 8] Drawing which expressed the relation of an input image (subject-copy image), a coded image, and a display image including the difference of the order of processing of a screen and the sequence of a

subject-copy side.

[Drawing 9] Drawing for explaining a progressive broadcasting method and an interlace scanning mode.

[Description of Notations]

401 [-- A video stream, 408 / -- A decode initiation timing control circuit, 413 / -- An audio decoder, 501 / -- The bit stream of video, 502 / -- The video syntax interpretation section, 503 / -- An MPEG system decoder, 504 / -- A PTS/DTS calculation circuit, 508 / -- The bit stream of an MPEG system 509 / -- Audio video stream.] -- The bit stream of an MPEG system, 402 -- An MPEG system decoder, 403 -- An MPEG video decoder, 407